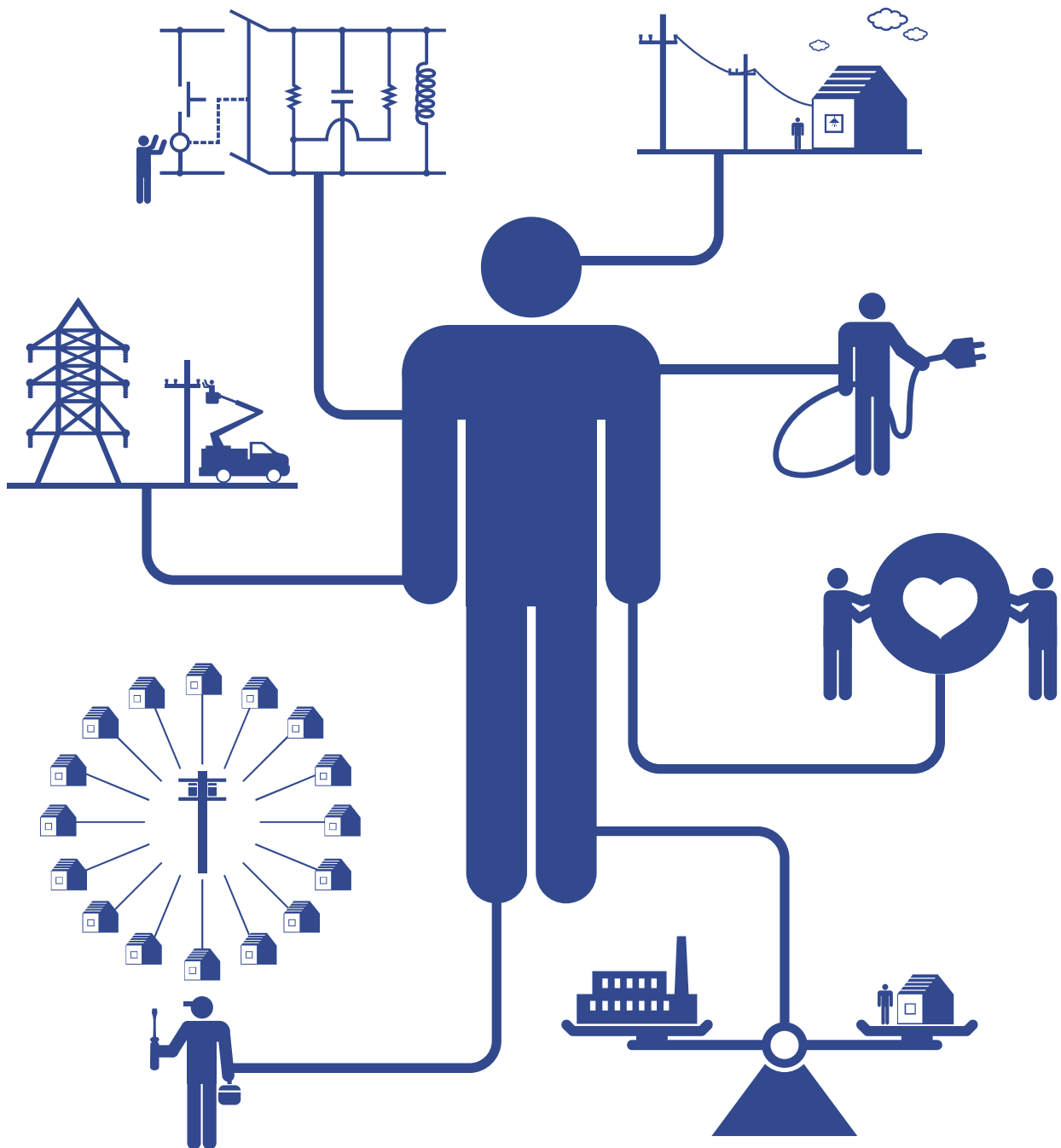


Chugoku Electric Power

~Innovation is a game changer in a deregulated market~



Chugoku Electric Power Company at a Glance

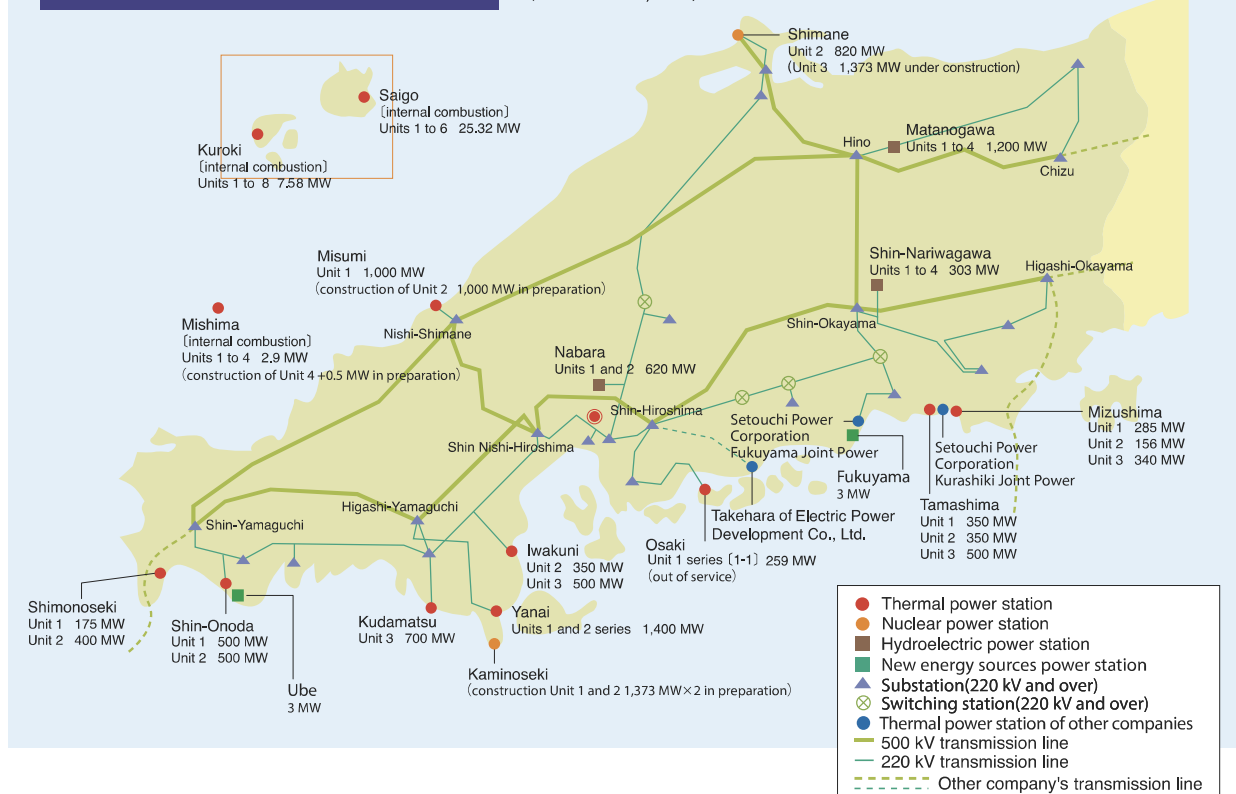
Chugoku Electric delivers energy through generation, transmission and distribution. There are 10 regional utility companies in Japan, and Chugoku Electric is the sixth largest by sales volume (kWh).

Corporate Data (as of March 31, 2018)

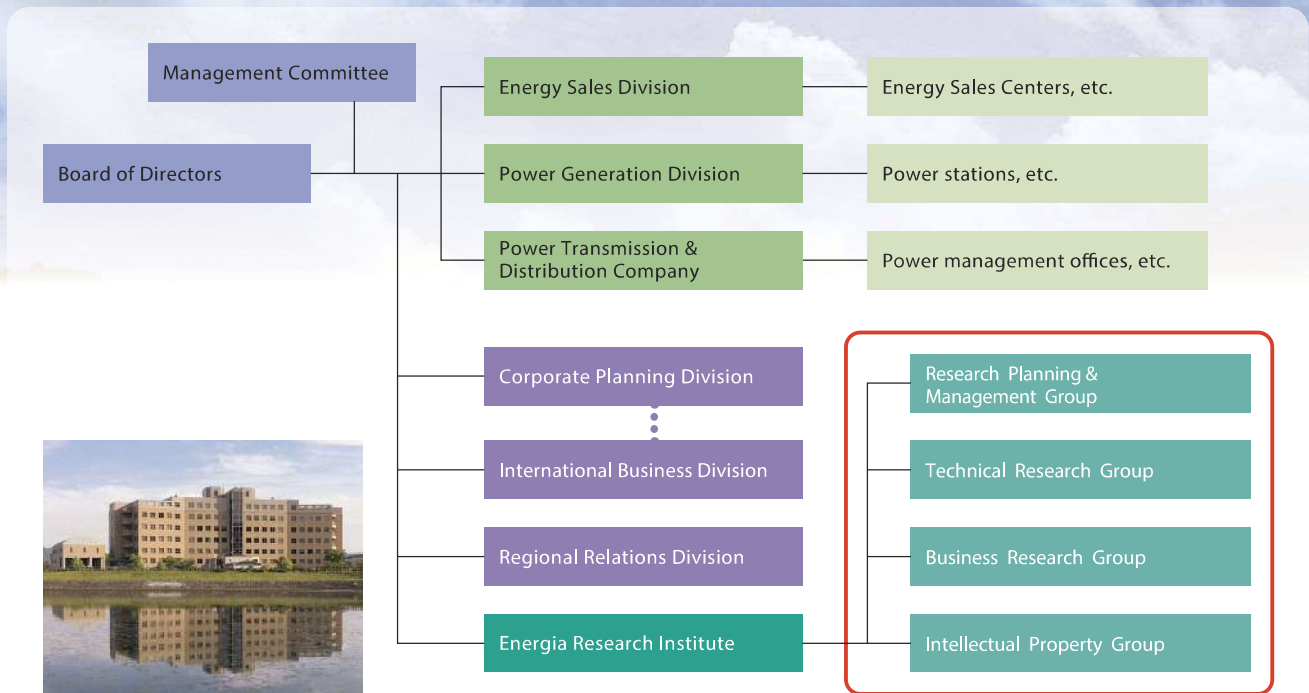
■ Corporate name	The Chugoku Electric Power Co., Inc.	
■ Head Office	4-33 Komachi, Naka-ku, Hiroshima 730-8701 Japan	
■ DATE established	May 1, 1951	
■ Paid-in capital	185.5 billion yen	
■ Common stock issued	371,055,259 stocks	
■ Number of employees	9,305	
■ Main supply facilities	Power stations and total output 114 stations 11,538 MW	
	Thermal	12 stations 7,802 MW
	Hydroelectric	99 stations 2,910 MW
	Nuclear	1 stations 820 MW
	New energy sources	2 stations 6 MW
	Electric energy output(by own company and others,total) 63,529 GWh	
	Thermal	53,752 GWh
	Hydroelectric	4,631 GWh
	Nuclear	0 GWh
	New energy sources	5,146 GWh
■ Main business places	Regional Offices: 5 Sales Offices: 30 Sales Center: 18	



Map of Major Supply Facilities (as of March 31, 2018)



Organizational Chart



Energy Research Institute is the R&D arm of Chugoku Electric.

Technical Research Group

Technologies for Electricity Cost Reduction and Stable Energy Supply

- Efficient inspection and maintenance of equipment
- Extended operational life of equipment
- Efficient construction of facilities
- Use of biomass

Information & Communication Technology

- Remote monitoring and control
- Telecommunications and information processing

Environmental Technology

- Analytics
- Measurement of heat-island effect
- Use and recycling of byproducts

Technologies for Advanced Electricity Use

Business Research Group

- Statistical analyses of regional economy and industrial trends
- Financial analyses, time-series analyses, and simulations

Powering the Bright Future

Backed with 20 years of research and development activities

Energy Research Institute takes the first step toward a brighter future.

Intellectual Property Group

- Development of the intellectual-property strategy
- Capitalization of the core technologies of Chugoku Electric
- Publishing intellectual-property reports

Research Planning and Management Group

- Publishing of journals on technical, economic, and regional
- Providing educational programs on eco-friendly electricity
- Providing Career training, seminars, internship, and open house

Intellectual Property

~A ticket to fair competition~

Since 2003, the Chugoku Electric Group as a whole has been striving with the intellectual property (IP) strategy aiming for strengthening Chugoku Electric's market competitiveness and enhancing its corporate value. Chugoku Electric has been the leader in the Japanese utility industry in terms of the number of patents granted annually since 2010 as well as the number in total since March 2013. (4,142 patents granted as of December 2015.)

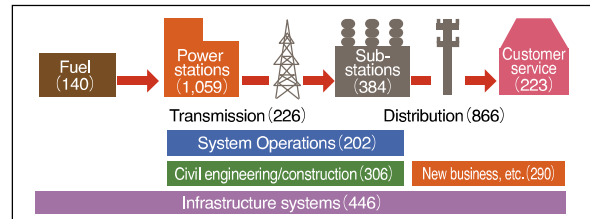
Chugoku Electric is in the sixth place globally for the number of patents related with smart grid control and monitoring technology and is ranked the third in Japan*1 for patents related with Home Energy Management System (HEMS). Chugoku Electric's technical capability and ability to capitalize it is recognized and highly regarded domestically as well as globally.

While using the own intellectual properties in its business, Chugoku Electric ensures it does not infringe third party's IP rights, which could negatively impact its business and operations. Chugoku Electric also actively cross-licenses its technology to monetize its IP assets and to cost-effectively access technologies Chugoku Electric doesn't have.

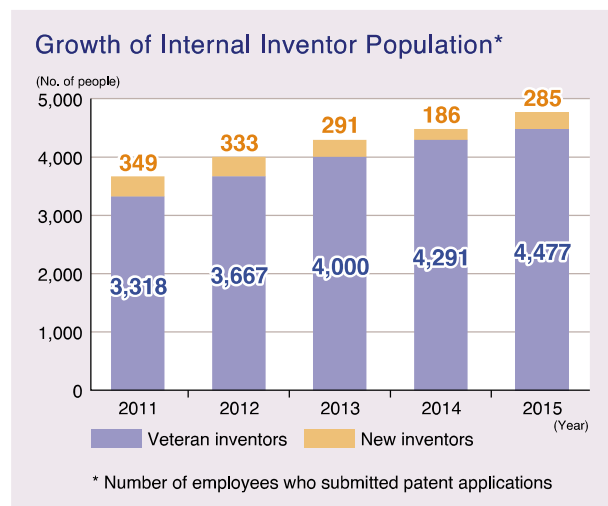
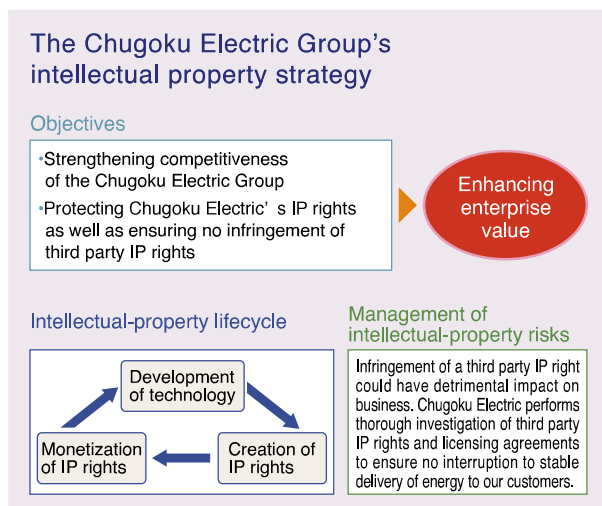
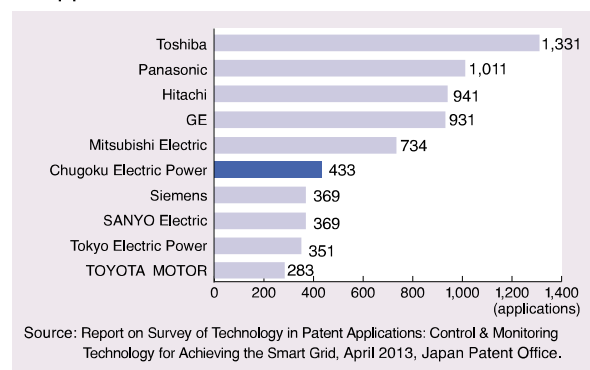
*1 Survey by Patent Result Co., Ltd

▶ Breakdown of Chugoku Electric's Patents

(AS of End of December 2015)



▶ Numbers of Smart Grid Related Patent Applications



Chugoku Electric's Technology Portfolio

POWER PLANT

- ▶ A life-extending method for high-temperature steam-pipes at a thermal power plant (火力発電所ボイラ蒸気配管の寿命延伸方法)
- ▶ A method for suppressing elution of noxious trace elements from coal ash at a coal-fired power plant (石炭火力発電所における微量物質溶出防止方法)
- ▶ Management of NOx removal catalysts for a thermal power plant (脱硝触媒の管理・再生技術)
- ▶ A testing kit for detecting larvae attached to an intake channel at a thermal power plant (発電所の海水取水路に付着する貝類の浮遊幼生検出装置)

NETWORK

- ▶ A method for optimizing energy supply and demand with positive feedback loop (需給一体制御方法)
- ▶ Technologies for Home Energy Management System (HEMS 関連技術)
- ▶ Contactless Charging System (非接触給電システム)

ENVIRONMENT

- ▶ Technologies for reusing coal ash (石炭灰利用技術)
- ▶ Low CO₂-emission concrete manufacturing (CO₂-Storage Under Infrastructure By Concrete Materials: CO₂-SUICOM) (環境配慮型コンクリート)

OTHER Technologies

- ▶ Detector for structural degradation of metal poles (金属柱劣化判定装置)
- ▶ Hydrogen-rich water generator for bathing (水素風呂装置)

POWER PLANT

“How simple bandages can significantly extend the life of a plant.”

A technology for extending the life of high temperature steam piping at a thermal power plant (火力発電所ボイラ蒸気配管の寿命延伸方法)

At a thermal power plant, an aging boiler can cause damages to the joints of its pipes. Chugoku Electric developed a simple repair solution using steel bands, which can be spot-wound on site.

Reinforcing with 10mm-thick SUS316-grade steel, the operational life of pipes becomes 4-6x longer.

“What if a grain of calcium makes coal well-behaved?”

A method for suppressing elution of noxious trace elements from coal ash at a coal-fired power plant (石炭火力発電所における微量物質溶出防止方法)

By adding slaked lime to coal ash before combustion, harmful trace materials generated in the combustion process are deposited onto the coal surface, preventing their release into the atmosphere.

Chugoku Electric's coal ash and other byproducts are fully compliant with all regulations.

In the previous process coal ash was treated to reduce solubility of trace materials.

Elution tests confirmed that most of trace materials were turned insoluble.

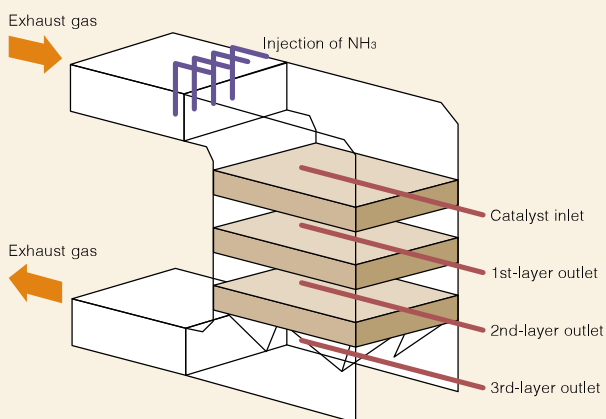
“When it gets dirty, replacement isn’t the only option; sometimes washing it in a large pool is the right thing to do.”

NOx removal technology for catalyst (脱硝触媒の管理・再生技術)

Accurate evaluation of denitrifying catalyst performance precisely gauges the catalyst replacement timing reducing the operational cost of the thermal power plant.

Catalyst management

Performance tests (1-2 time/year): Measurement of intake and output of NOx, NH3, and other gases at each catalyst layer.



This technology suggests the best option for restoring the performance of catalyst.



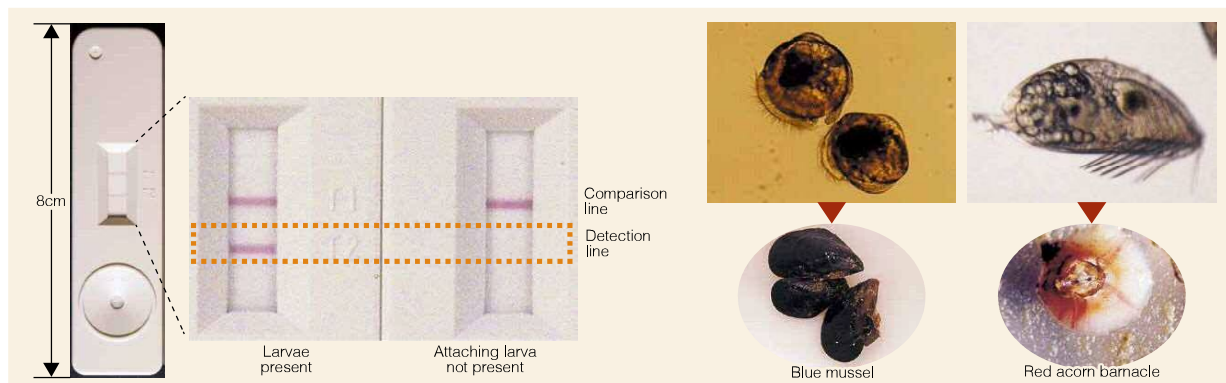
- Evaluation of catalyst performance and other degrading factors.
- Design, supply, and regeneration of optimal catalysts

“Through decades of maintaining our power stations, we know tiny creatures can be a threat.”

A test kit for detecting larvae attached to an intake channel at a thermal power plant (発電所の海水取水路に付着する貝類の浮遊幼生検出装置)

At a thermal power plant in Japan where sea water is used for cooling, occlusion of intake channels could result in a shut down of the power plant.

Chugoku Electric developed a simple, real-time sensor for larvae of barnacles such as blue mussels and red acorn barnacles that will soon attach themselves to intake channels.



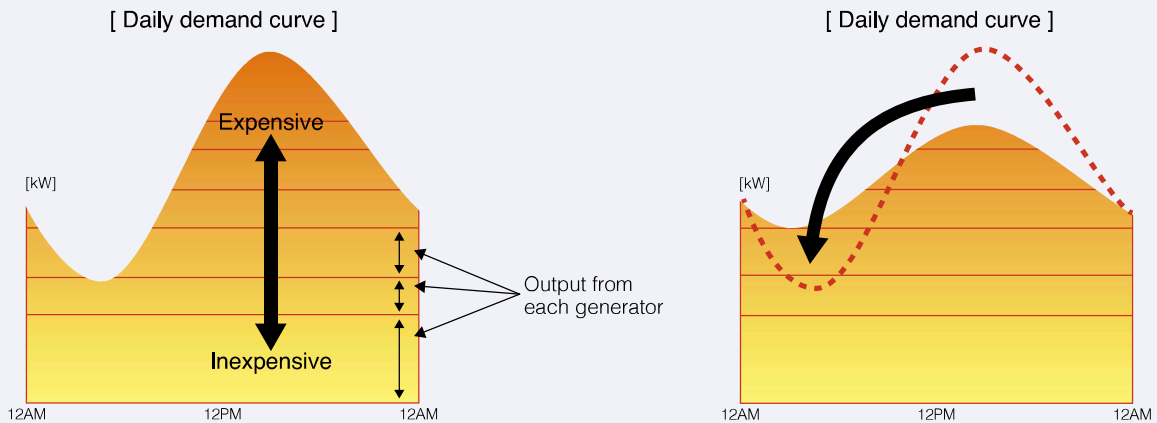
NETWORK

“A power grid can be smarter with a mediator.”

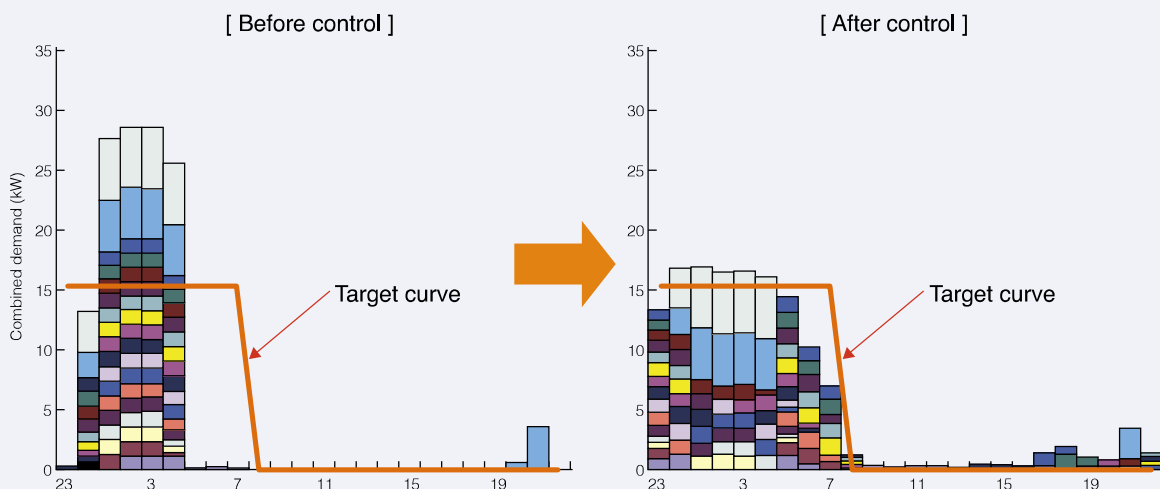
A control system with a positive feedback loop for optimal supply-and-demand (需給一体制御方法)

The supply-and-demand control system Chugoku Electric developed sends pricing signals from the supply side to the demand devices, which adjusts the operations plan to achieve the most optimal total price. The updated operations plan is sent back to the supply side for verification of supply-and-demand balance. Iteration of this positive feedback loop process allows the near ideal balanced operations.

This technology, integrating power demand and generation data, helps reduction of the thermal power generation cost.



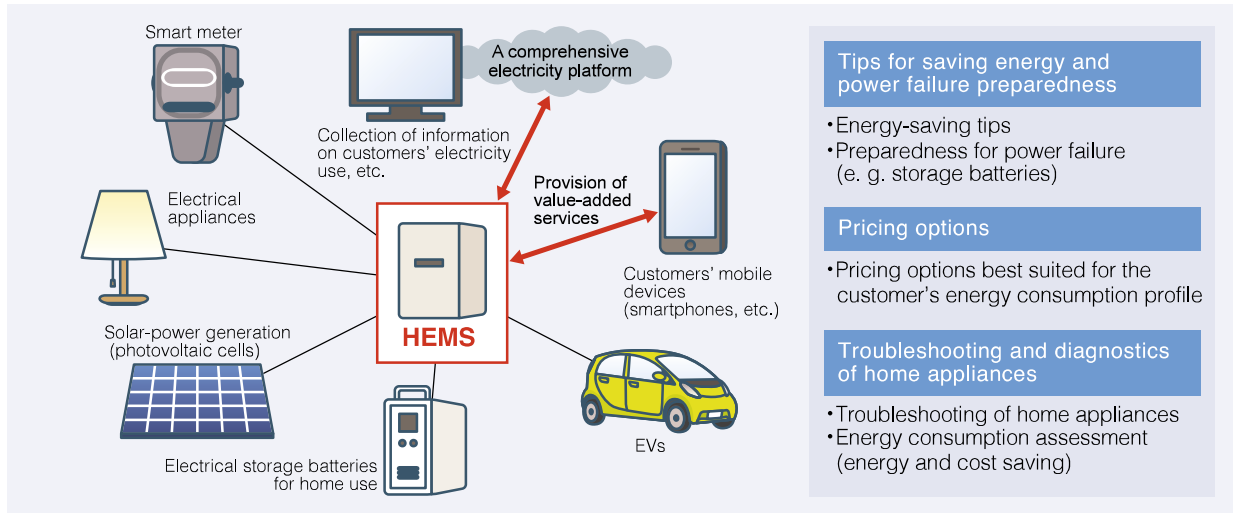
Chugoku Electric demonstrated that this technology could control the demand to be well aligned with the target curve.



“Home Energy Management System can deliver OMOTENASHI.”

Home Energy Management System Technology (HEMS 関連技術)

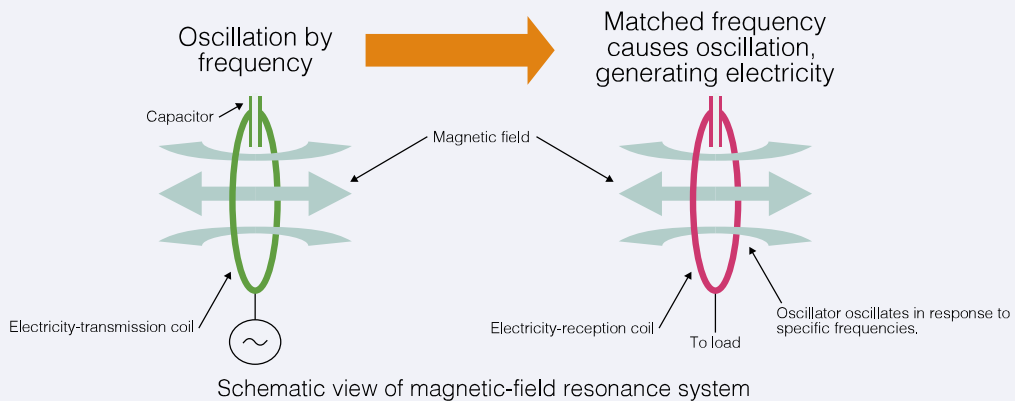
Chugoku Electric’s HEMS, BEMS, and other ICT solutions offer value-added services and help customers to save energy consumption and optimize their utility bills.



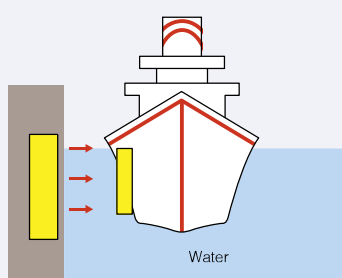
“Can you charge a device anywhere?”

Contactless Charging System (非接触給電システム)

R&D projects for efficient power supply



Contactless power supply use cases



- Under water
- Where cabling is infeasible



Charging of EVs



Charging of EVs as they travel

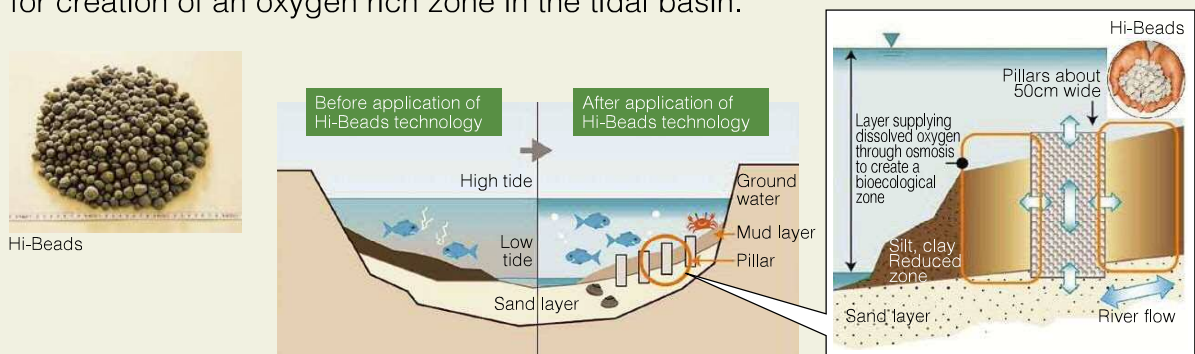
ENVIRONMENT

“From tiny beads to large blocks, coal ash is everywhere in our daily life.”

Coal ash reuse technology (石炭灰利用技術)

Aiming for zero emission, Chugoku Electric uses technologies for Reduce, Reuse and Recycle.

Osmotic “Hi-Beads,” Chugoku Electric’s patented coal ash-based product, are used for creation of an oxygen rich zone in the tidal basin.

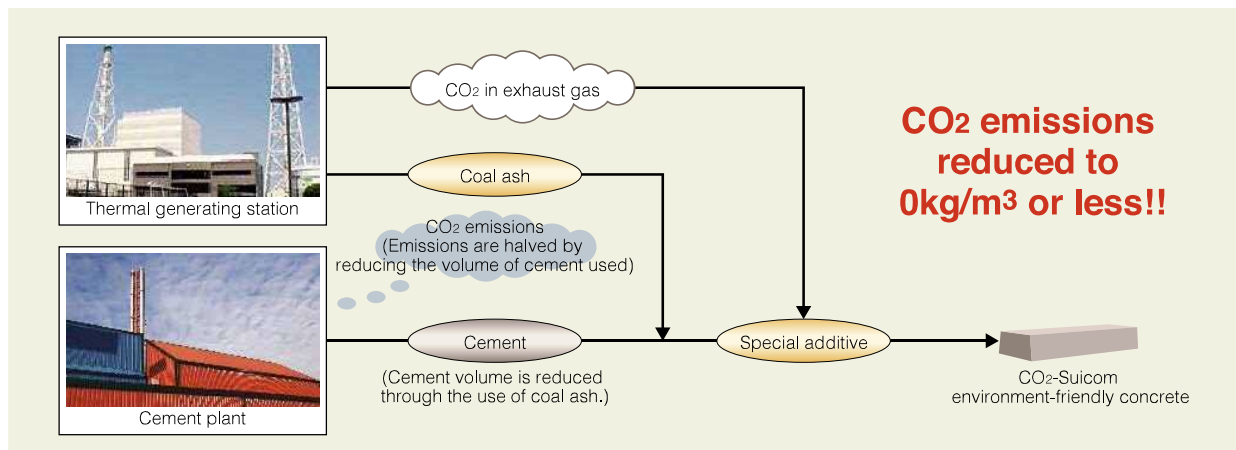


Large breakwater blocks (20–80t) at a nuclear power station are made with coal ash produced at coal-fired thermal generating stations.

“What if concrete blocks absorb CO₂?”

CO₂-Absorbing Concrete (環境配慮型コンクリート(CO₂-SUICOM))

Chugoku Electric developed the concrete that reduces effective CO₂ emission to less than zero.



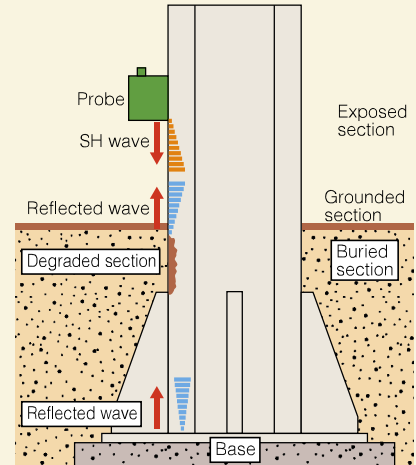
Other technologies

“Annual check-up of a metal pole”

Metal Pole Structural Degradation Detector (金属柱劣化判定装置)

A device to detect structural damage of metal poles

Chugoku Electric’s ultrasonic flaw detection technology finds material degeneration, corrosion, and other damages to the segment of a metal pole under ground without digging around the pole.

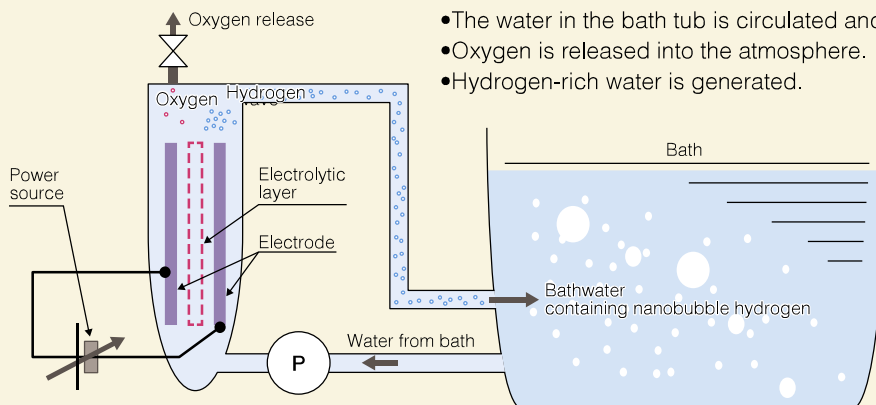


“For your health and beauty, hydrogen-rich bath is at your service.”

Device for generating hydrogen-rich bath (水素風呂装置)

Chugoku Electric developed a technology to generate hydrogen-rich, low oxidation-reduction potential (ORP) water. Ordinary water contains less than 0.01ppm of free hydrogen while the concentration level of Chugoku Electric’s hydrogen-rich water is no less than 0.3 ppm, thanks to hydrogen micro-bubbles.

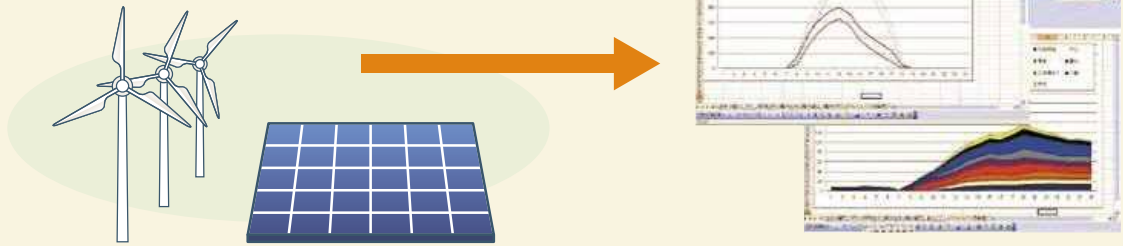
Schematic View of System



- The water in the bath tub is circulated and electrolyzed.
- Oxygen is released into the atmosphere.
- Hydrogen-rich water is generated.



Prediction of Solar and Wind Energy Output Using Weather Forecast Data

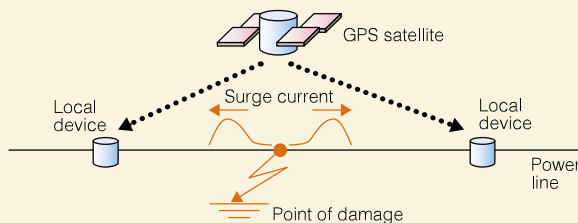


Methods and Tools for Working with a Live Wire without Touching It



GPS-based High-Precision Determination of Damaged Point of a Power Line

There are multiple GPS time signal receivers on the ground for time synchronization. The technology Chugoku Electric developed uses the difference in time it takes the surge current to arrive at these terminals on the distribution lines to determine where exactly a grounding fault has occurred.



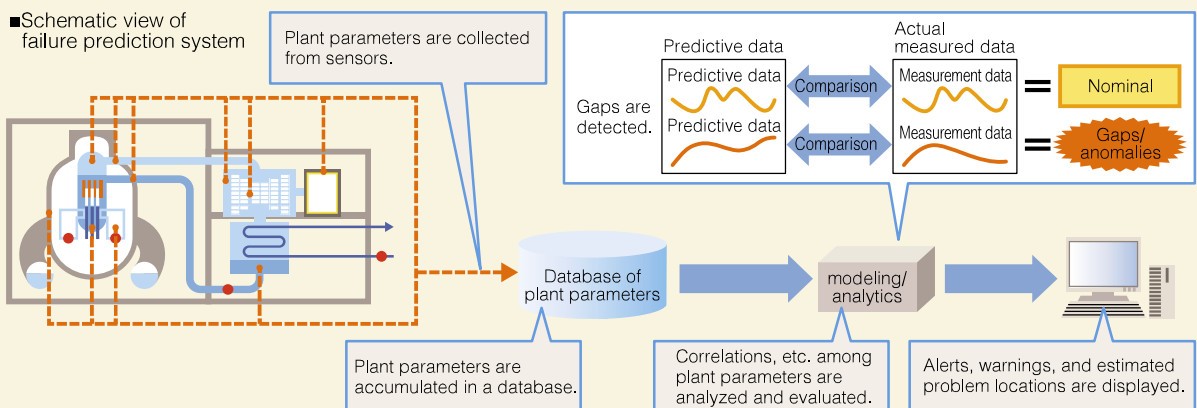
Technology to straighten up a leaning steel tower

This is a technology to pull up a post with a hydraulic jack to insert a spacer to level the tower again when the foundation of the post supporting a tower with 3 other posts has sunk due to an earthquake or another cause.



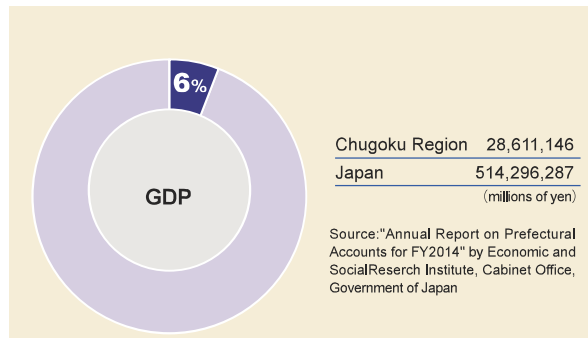
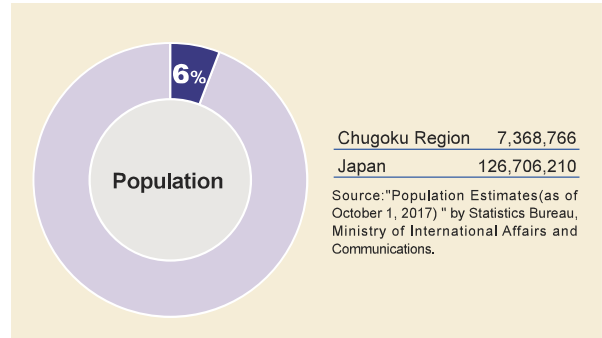
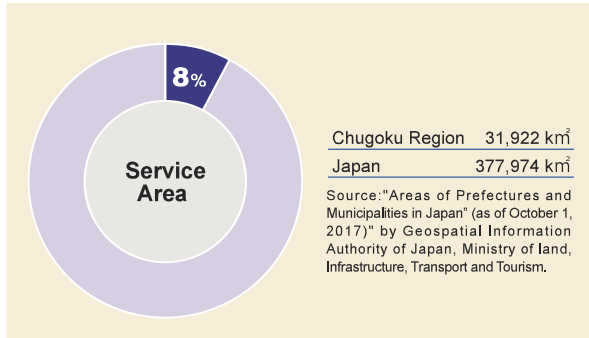
Big Data analytics is used for a system for prediction of abnormalities and failures at a power station.

■ Schematic view of failure prediction system



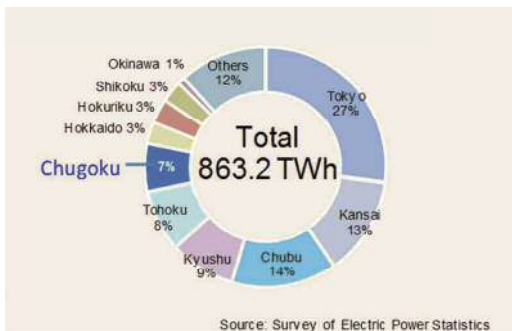
In this report, the term "Fiscal year 2018" refers to the period which ended March 31, 2018. However, this does not apply to the referenced sources.

Characteristics of Chugoku Region

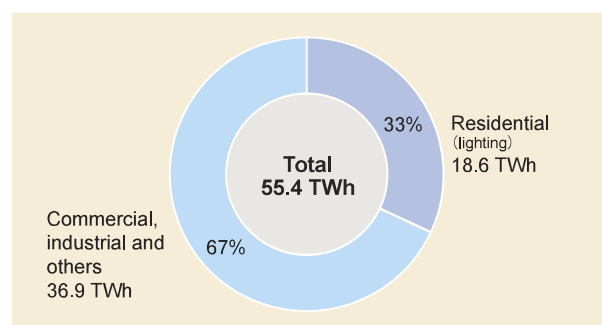


Characteristics of Chugoku Electric

Electric Sales Share by company



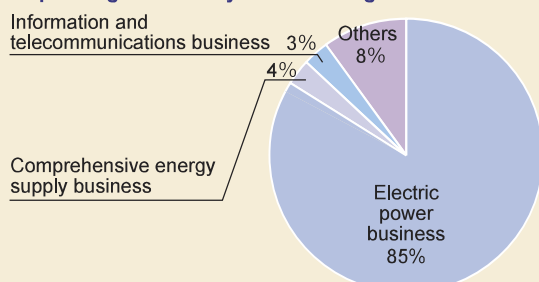
Electric Sales Volume by Demand Type



Operating revenues by Segment

In order to meet our customers' increasingly diverse needs, we are engaged in providing services leading to enhanced convenience and comfort for customers, primarily in the electric power business but also in other areas including comprehensive energy supply business and information and telecommunication business.

Operating Revenue by Business Segment



Segment	Operating Revenue (FY 2018)	Business content
Electric power business	1,201.3 billion yen	Electric power supply
Comprehensive energy supply business	50.3 billion yen	Fuel sales business, electricity and thermal energy supply business
Information and telecommunications business	41.0 billion yen	Telecommunications business, data processing business

Others includes business such as environmental harmony creation business / lifestyle support, and electric power business support.



With you, and with the Earth.
The Chugoku Electric Power Co., Inc

The Chugoku Electric Power Co., Inc.

Energia Research Institute

Head Office

3-9-1 Kagamiyama, Higashi-Hiroshima 739-0046 Phone:+81-82-420-0700

Hiroshima Branch

4-33 Komachi, Naka-ku, Hiroshima 730-8701 Phone:+81-82-544-8150

<http://www.energia.co.jp>

(Revised October 2018)